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SDLS153A – JANUARY 1981 – REVISED JANUARY 2016

# SN74LS29x Programmable Frequency Dividers and Digital Timers

Technical

Documents

## 1 Features

- Count Divider Chain
- Digitally Programmable from 2<sup>2</sup> to 2<sup>n</sup> (n = 31 for SN74LS292, n = 15 for SN74LS294)
- Useable Frequency Range from DC to 30 MHz
- Easily Expandable

## 2 Applications

- Frequency Division
- Digital Timing

## 3 Description

Tools &

Software

The SN74LS29x devices are programmable frequency dividers and digital timers contain 31 flip-flops plus 30 gates (in SN74LS292) or 15 flip-flops plus 29 gates (in SN74LS294) on a single chip. The count modulo is under digital control of the inputs provided.

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2.2

Both types feature an active-low CLR clear input to initialize the state of all flip-flops. To facilitate the incoming inspection, test points are provided (TP1, TP2, and TP3 on the SN74LS292, and TP on the SN74LS294). These test points are not intended to drive system loads. Both types feature two clock inputs; either one may be used for clock gating (see Table 1).

A brief look at the digital timing capabilities of the SN74LS292 shows that with a 1-MHz input frequency, programming for  $2^{10}$  gives a period of 1.024 ms,  $2^{20}$  gives a period of 1.05 sec,  $2^{26}$  gives a period of 1.12 min, and  $2^{31}$  gives a period of 35.79 min.

These devices are easily cascadable, giving limitless possibilities to achievable timing delays.

Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)		
SN74LS292N		6.25 mm + 10.20 mm		
SN74LS294N	PDIP (16)	6.35 mm × 19.30 mm		

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Logic Symbols

EXAS

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## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

CI	hanges from Original (January 1981) to Revision A	Page
•	Removed SN54LS292 and SN54LS294 from the data sheet	1
•	Added ESD Ratings and Thermal Information tables, Feature Description section, Device Functional Modes section Application and Implementation section, Power Supply Recommendations section, Layout section, Device and Documentation Support section, and Mechanical, Packaging, and Orderable Information section.	, 1

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# 5 Pin Configuration and Functions

SN74LS29x J, W, or N Package 16-Pin PDIP Top View						
B [ E [ TP 1 [ CLK 1 [ CLK 2 [ TP 2 [ Q [	1 2 3 4 5 6 7	16 V <sub>CC</sub> 15 C 14 D 13 TP 3 12 NC 11 CLR 10 A				

### Pin Functions, SN74LS292

PIN		1/0	DESCRIPTION	
NAME	PDIP	1/0	DESCRIPTION	
А	10	I	Programming input A	
В	1	I	Programming input B	
С	15	I	Programming input C	
CLK1	4	I	Clock 1 input	
CLK2	5	I	Clock 2 input	
CLR	11	I	Active-low clear input	
D	14	I	Programming input D	
E	2	I	Programming input E	
GND	8	-	Ground	
NC	9, 12	-	No connect	
Q	7	0	Q Output	
TP	—	0	Test Point	
TP1	3	0	Test Point	
TP2	6	0	Test Point	
TP3	13	0	Test Point	
V <sub>CC</sub>	16	-	Power	

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#### Pin Functions, SN74LS294

PIN		1/0	DESCRIPTION	
NAME	PDIP	10	DESCRIPTION	
А	2	I	Programming input A	
В	1	I	Programming input B	
С	15	I	Programming input C	
CLK1	4	I.	Clock 1 input	
CLK2	5	I	Clock 2 input	
CLR	11	I	Active-low clear input	
D	14	I	Programming input D	
E	—	I	Programming input E	
GND	8	-	Ground	
NC	6, 9 ,10, 12, 13	-	No connect	
Q	7	0	Q Output	
TP	3	0	Test Point	
TP1	_	0	Test Point	
TP2	—	0	Test Point	
TP3	_	0	Test Point	
V <sub>CC</sub>	16	-	Power	

## 6 Specifications

## 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub> <sup>(2)</sup> Supply vo	ltage		7	V
Input volt	age		7	V
T <sub>J</sub> Junction 1	emperature		150	°C
T <sub>stg</sub> Storage t	emperature	-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) Voltage values are with respect to network ground terminal.

## 6.2 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

				MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage			4.75	5	5.25	V
VIH	High-level input voltage			2			V
VIL	Low-level input voltage					0.8	V
I <sub>OH</sub>	High-level output current (Q or	nly)				-1.2	mA
I <sub>OL</sub>	Low-level output current (Q only)					24	mA
f <sub>clock</sub>	Clock frequency			0		30	MHz
t <sub>w</sub>	Duration of clock input pulse			16			ns
	Duration of closer pulse	SN74LS292	2	55			~~
۱ <sub>w</sub>	Duration of clear pulse	SN74LS294	ļ	35			ns
t <sub>su</sub>	Clear inactive-state set-up time	e		15			ns
T <sub>A</sub>	Operating free-air temperature			0		70	°C

## 6.3 Thermal Information

		SN74LS292		
	THERMAL METRIC <sup>(1)</sup>	N (PDIP)	UNIT	
		16 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	36.8	°C/W	
R <sub>0JC(top)</sub>	Junction-to-case (top) thermal resistance	22.2	°C/W	
$R_{\theta JB}$	Junction-to-board thermal resistance	17.0	°C/W	
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	7.0	°C/W	
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	16.8	°C/W	

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report, SPRA953.

### 6.4 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS <sup>(1)</sup>		MIN	TYP <sup>(2)</sup>	MAX	UNIT
V <sub>IK</sub>	$V_{CC} = MIN, I_I = -18 \text{ mA}$				-1.5	V	
V <sub>OH</sub>	Q	$V_{CC} = MIN, V_{IH} = 2 V, I_{OH} = -1.2 mA,$	V <sub>IL</sub> = MAX	2.4	3.4		V
			I <sub>OL</sub> = 12 mA		0.25	0.4	
V <sub>OL</sub>	Q	$V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX$	I <sub>OL</sub> = 24 mA		0.35	0.5	V
	TP <sup>(3)</sup>		I <sub>OL</sub> = 0.5 mA		0.25	0.4	
II.		$V_{CC} = MAX, V_I = 7 V$				0.1	mA
I <sub>IH</sub>		$V_{CC} = MAX, V_I = 2.7 V$				20	mA
	CLK1, CLK2	$V_{CC} = MAX, V_I = 0.4 V$				-0.8	A
IIL.	All others	$V_{CC} = MAX, V_I = 0.4 V$				-0.4	ШA
$I_{OS}^{(4)}$	Q	$V_{CC} = MAX$		-30		-130	mA
	SN74LS292	V <sub>CC</sub> = MAX, all inputs grounded, all ou	tputs open		40	75	~ ^
V <sub>OL</sub> I <sub>I</sub> I <sub>IH</sub> I <sub>IL</sub> I <sub>OS</sub> <sup>(4)</sup> I <sub>CC</sub>	SN74LS294	V <sub>CC</sub> = MAX, all inputs grounded, all out	tputs open		30	50	ШA

(1) For conditions shown as MIN or MAX, use the appropriate value specified under Recommended Operating Conditions.

(2)

All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ . The TP output or outputs are not intended to drive external loads, but are solely provided for test points. (3) (4)

The duration of the short-circuit should not exceed one second.

## 6.5 Switching Characteristics

 $V_{CC} = 5 \text{ V}, \text{ } \text{T}_{\text{A}} = 25^{\circ}\text{C}, \text{ } \text{R}_{\text{L}} = 667 \text{ } \Omega, \text{ } \text{C}_{\text{L}} = 45 \text{ } \text{pF} \text{ (see Figure 1)}$ 

PARAMETER	TEST CONDITI	ONS	MIN	TYP	MAX	UNIT
f <sub>max</sub>	From CLK1 or 2		30	50		MHz
t <sub>PLH</sub>	From CLK1 or 2, to Q; Modulo set at $2^2$ (xxxxLS292), A through D = LLHL (xxxx	, A through # = LLLHL KLS294)		55	90	ns
	From CLK1 or 2, to Q; Modulo set at $2^2$ (xxxxLS292), A through D = LLHL (xxxx	, A through # = LLLHL KLS294)		80	120	
t <sub>PHL</sub>		SN74LS292		85	130	ns
		SN74LS294		35	65	



Figure 1. Switching Loads





Figure 2. Timing Diagram









### 7 Parameter Measurement Information

## 7.1 Logic Diagrams



These symbols are in accordance with ANSi/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for J, N, and W packages.



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## Logic Diagrams (continued)



Pin numbers shown are for J, N, and W packages.



8



## Logic Diagrams (continued)



Pin numbers shown are for J, N, and W packages.

Figure 6. Logic Diagram (Positive Logic) SN74LS294

## 8 Detailed Description

#### 8.1 Overview

*Functional Block Diagram* shows that the count modulo is controlled by an X/Y decoder connected to the mode control inputs of several flip-flops. These flip-flops with mode controls each have a D input connected to the parallel clock line, and a T input driven by the preceding stage. The parallel clock frequency is always the input frequency divided by four.

The X/Y decoder output selected by the programming inputs goes low. While a mode control is slow, the D input of that flip-flop is enabled, and the signal from the parallel clock line ( $f_{in} \div 4$ ) is passed to the T input of the following stage. All the other mode controls are high, enabling the T inputs and causing each flip-flop in turn to divide by two.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

This SN74LS29x device can be used to digitally program from  $2^2$  to  $2^n$  (n = 31 for SN74LS292, n = 15 for SN74LS294) divider chain. This has a useable frequency range up to 30 MHz. The flexibility is offered when the devices are cascaded to have desired timing delay.

### 8.4 Device Functional Modes

 Table 1, Table 2, and Table 3 list the functional modes of the SN74LS292.

CLEAR	CLK1	CLK2	Q OUTPUT MODE
L	Х	Х	Cleared to L
Н	↑	L	Count
Н	L	↑ (	Count
Н	н	Х	Inhibit
Н	Х	Н	Inhibit

#### Table 1. Function Table



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## Table 2. SN74LS292 Function Table

					FREQUENCY DIVISION										
	FROGE	AWWWWWG	INFUIS			Q	т	P1	Т	P2	т	P3			
E	D	С	В	Α	BINARY	DECIMAL	BINARY	DECIMAL	BINARY	DECIMAL	BINARY	DECIMAL			
L	L	L	L	L	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit			
L	L	L	L	н	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit	Inhibit			
L	L	L	Н	L	2 <sup>2</sup>	4	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	L	L	н	н	2 <sup>3</sup>	8	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	L	н	L	L	2 <sup>4</sup>	16	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	L	н	L	н	2 <sup>5</sup>	32	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	L	н	н	L	2 <sup>6</sup>	64	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	L	н	н	н	27	128	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
L	н	L	L	L	2 <sup>8</sup>	256	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>2</sup>	4			
L	н	L	L	н	2 <sup>9</sup>	512	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>2</sup>	4			
L	н	L	н	L	2 <sup>10</sup>	1024	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	24	16			
L	н	L	н	н	2 <sup>11</sup>	2048	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	24	16			
L	н	н	L	L	2 <sup>12</sup>	4096	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>6</sup>	64			
L	н	н	L	н	2 <sup>13</sup>	8192	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>6</sup>	64			
L	н	н	н	L	2 <sup>14</sup>	16384	2 <sup>9</sup>	512	Disabled low	Disabled low	2 <sup>8</sup>	256			
L	н	н	н	н	2 <sup>15</sup>	32768	2 <sup>9</sup>	512	Disabled low	Disabled low	2 <sup>8</sup>	256			
н	L	L	L	L	2 <sup>16</sup>	65536	2 <sup>9</sup>	512	2 <sup>3</sup>	8	2 <sup>10</sup>	1024			
н	L	L	L	н	2 <sup>17</sup>	131072	2 <sup>9</sup>	512	2 <sup>3</sup>	8	2 <sup>10</sup>	1024			
н	L	L	н	L	2 <sup>18</sup>	262144	2 <sup>9</sup>	512	2 <sup>5</sup>	32	2 <sup>12</sup>	4096			
н	L	L	н	н	2 <sup>19</sup>	524288	2 <sup>9</sup>	512	2 <sup>5</sup>	32	2 <sup>12</sup>	4096			
н	L	н	L	L	2 <sup>20</sup>	1048576	2 <sup>9</sup>	512	27	128	2 <sup>14</sup>	16384			
н	L	н	L	н	2 <sup>21</sup>	2097152	2 <sup>9</sup>	512	2 <sup>7</sup>	128	2 <sup>14</sup>	16384			
н	L	н	н	L	2 <sup>22</sup>	4194304	Disabled low	Disabled low	2 <sup>9</sup>	512	2 <sup>16</sup>	65536			
н	L	н	н	н	2 <sup>23</sup>	8388608	Disabled low	Disabled low	2 <sup>9</sup>	512	2 <sup>16</sup>	65536			
н	н	L	L	L	2 <sup>24</sup>	16777216	2 <sup>3</sup>	8	2 <sup>11</sup>	2048	2 <sup>18</sup>	262144			
н	н	L	L	н	2 <sup>25</sup>	33554432	2 <sup>3</sup>	8	2 <sup>11</sup>	2048	2 <sup>18</sup>	262144			
н	н	L	н	L	2 <sup>26</sup>	67108864	2 <sup>5</sup>	32	2 <sup>13</sup>	8192	2 <sup>20</sup>	1048576			
н	н	L	н	н	2 <sup>27</sup>	134217728	2 <sup>5</sup>	32	2 <sup>13</sup>	8192	2 <sup>20</sup>	1048576			
н	н	н	L	L	2 <sup>28</sup>	268435456	2 <sup>7</sup>	128	2 <sup>15</sup>	32768	2 <sup>22</sup>	4194304			
н	н	н	L	н	2 <sup>29</sup>	536870912	2 <sup>7</sup>	128	2 <sup>15</sup>	32768	2 <sup>22</sup>	4194304			
н	н	н	н	L	2 <sup>30</sup>	1073741824	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			
н	н	н	н	н	2 <sup>31</sup>	2147483648	2 <sup>9</sup>	512	2 <sup>17</sup>	131072	2 <sup>24</sup>	16777216			

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				FREQUENCY DIVISION							
PROGRAMMING INPUTS			015		Q	TP					
D	С	В	Α	BINARY	DECIMAL	BINARY	DECIMAL				
L	L	L	L	Inhibit	Inhibit	Inhibit	Inhibit				
L	L	L	Н	Inhibit	Inhibit	Inhibit	Inhibit				
L	L	н	L	2 <sup>2</sup>	4	2 <sup>9</sup>	512				
L	L	н	н	2 <sup>3</sup>	8	2 <sup>9</sup>	512				
L	н	L	L	2 <sup>4</sup>	16	2 <sup>9</sup>	512				
L	н	L	н	2 <sup>5</sup>	32	2 <sup>9</sup>	512				
L	н	н	L	2 <sup>6</sup>	64	2 <sup>9</sup>	512				
L	н	н	н	2 <sup>7</sup>	128	Disabled Low					
Н	L	L	L	2 <sup>8</sup>	256 2 <sup>2</sup>		4				
Н	L	L	н	2 <sup>9</sup>	512	2 <sup>3</sup>	8				
Н	L	н	L	2 <sup>10</sup>	1024	2 <sup>4</sup>	16				
Н	L	н	н	2 <sup>11</sup>	2048	2 <sup>5</sup>	32				
Н	н	L	L	2 <sup>12</sup>	4096	2 <sup>6</sup>	64				
Н	Н	L	н	2 <sup>13</sup>	8192	2 <sup>7</sup>	128				
Н	Н	н	L	2 <sup>14</sup>	16384	2 <sup>8</sup>	256				
Н	н	н	н	2 <sup>15</sup>	32768	2 <sup>9</sup>	512				

#### Table 3. SN74LS294 Function Table

Figure 7, Figure 9, and Figure 9 show the schematics of inputs and outputs of the SN74LS292.













Figure 9. Typical of TP Outputs

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## 9 Application and Implementation

#### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

#### 9.1 Application Information

This device is used for configurable frequency, programmable frequency, and timing division as shown in *Typical Application*.

#### 9.2 Typical Application



Figure 10. Typical application

#### 9.2.1 Design Requirements

This device does not have balanced output drive. Take care to avoid bus contention because it can sink currents that would exceed maximum limits. The high drive will also create fast edges into light loads so routing and load conditions should be considered to prevent ringing.

#### 9.2.2 Detailed Design Procedure

- 1. Recommended Input Conditions:
  - Rise time and fall time specs. See (Δt/ΔV) in Recommended Operating Conditions.
  - Specified high and low levels. See (V<sub>IH</sub> and V<sub>IL</sub>) in *Recommended Operating Conditions*.
  - Inputs can go as high as (V<sub>1</sub> max) in *Recommended Operating Conditions* at any valid V<sub>CC</sub>.
- 2. Recommended Output Conditions:
  - Load currents should not exceed (I<sub>OH</sub>,I<sub>OL</sub>) per output. These limits are located in the *Recommended* Operating Conditions.

## **Typical Application (continued)**

### 9.2.3 Application Curve



## 10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in *Recommended Operating Conditions*.

Each V<sub>CC</sub> pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- $\mu$ F capacitor is recommended and, if there are multiple V<sub>CC</sub> pins, then a 0.01- $\mu$ F or 0.022- $\mu$ F capacitor is recommended for each power pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

## 11 Layout

### 11.1 Layout Guidelines

When using multiple bit logic devices, inputs should not ever float. In many cases, functions or parts of functions of digital logic devices are unused (for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used). Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

The following are the rules that must be observed under all circumstances:

- All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating.
- The logic level that must be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or V<sub>CC</sub>, whichever make more sense or is more convenient.

## 11.2 Layout Example



Figure 12. Generic Layout Best Practices



## **12 Device and Documentation Support**

### **12.1** Documentation Support

### 12.1.1 Related Documentation

For related documentation, see the following:

- Digital Phase-Locked Loop Design Using SN74LS297, SDLA005
- Introduction to Logic, SLVA700

### 12.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table	4.	Related	Links
-------	----	---------	-------

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY	
SN74LS292	Click here	Click here	Click here	Click here	Click here	
SN74LS294	Click here	Click here	Click here	Click here	Click here	

### 12.3 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E<sup>™</sup> Online Community *TI's Engineer-to-Engineer (E2E) Community.* Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support TI's Design Support** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

## 12.4 Trademarks

E2E is a trademark of Texas Instruments. All other trademarks are the property of their respective owners.

## 12.5 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 12.6 Glossary

SLYZ022 — TI Glossary.

This glossary lists and explains terms, acronyms, and definitions.

## 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.



## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type	Package   Pins	Package qty   Carrier	<b>RoHS</b> (3)	Lead finish/ Ball material	MSL rating/ Peak reflow	Op temp (°C)	Part marking (6)
						(4)	(5)		
SN74LS292N	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS292N
SN74LS294N	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS294N

<sup>(1)</sup> **Status:** For more details on status, see our product life cycle.

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TEXAS INSTRUMENTS

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9-Feb-2024

## TUBE



## - B - Alignment groove width

\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	Τ (μm)	B (mm)
SN74LS292N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS294N	N	PDIP	16	25	506	13.97	11230	4.32

# N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

- A. All linear dimensions are in inches (millimeters).B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- $\triangle$  The 20 pin end lead shoulder width is a vendor option, either half or full width.



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